H2020-SC5-01-2017

MED-GOLD

Turning climate-related information into added value for traditional **MED**iterranean **G**rape, **OL**ive and **D**urum wheat food systems

Deliverable 6.15

Dissemination and Capacity Building Materials n.2

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Document Status Sheet

Deliverable Title	**Dissemination and Capacity Building Materials nº2**	
Brief Description	Description and collection of the dissemination and capacity building materials created from M25 (December 2019) to M36 (November 2020)	
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REVISION HISTORY LOG

Version	Date	Created / Modified by	Pages	Comments
1.0	02-11-2020	BSC	25	Initial Draft

All partners involved in the production/implementation of the deliverable should comment and report (if needed) in the above table. The above table should support the decisions made for the specific deliverable in order to include the agreement of all involved parties for the final version of the document.

Finally, after the peer review process, the deliverable should be modified accordingly to the comments and the reflections to the comments should be reported in the above table.

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EXECUTIVE SUMMARY

Scientific results need effective dissemination to explain the wider societal relevance of science, build support for future research and innovation funding, ensure uptake of results within the scientific community, and open up potential business opportunities for novel products or services. However, to ensure results' uptake, building capacity within the user community is crucial, which helps to enhance their capabilities and skills and develop a dedicated understanding that can be useful for problem-solving. In turn, capacity building leads to a more efficient dissemination of actionable interdisciplinary knowledge to other users and user groups, for adaptation and planning in the context of climate change.

This deliverable presents a description of the dissemination and capacity building materials that have been developed within the framework of the MED-GOLD project. They are aimed to ensure uptake of climate services by agricultural stakeholders, namely by user communities from grapes/wine, olives/olive oil and durum wheat/pasta sectors, but also by other sectors beyond those. This deliverable contains dissemination materials developed from month 25 of the project (December 2019) to month 36 (November 2020). Materials are addressed to different audiences (i.e. scientific peers, farmers, cooperatives, the business sector, public organizations, policy makers), depending on the format the information is presented, the terminology used and the chosen distribution channel.

Actions to enhance the distribution of dissemination and capacity building materials during periods with travel restrictions due to the COVID-19 pandemic have involved the organisation of and participation in online events as well a more intense use of social networks. Such actions have the aim to increase the impact of the project on the target audiences. Metrics to assess the impact of dissemination and capacity building are also proposed in the final part of the document.

Next steps in dissemination and capacity building will include the development of appropriate materials to present the climate services developed in the MED-GOLD project (info sheets, short videos, organization of webinars, presentation at public or online events, etc.), the development of a series of policy briefs addressed to the policy community, and the organisation of a policy event together with our sister project VISCA (focusing on climate services for the wine sector).

1. OBJECTIVES

With this deliverable, the project has contributed to the achievement of the following objectives (DOA, PartB Table1.1):

No.	Objective	Yes
1	To co-design, co-develop, test, and assess the added value of proof-of-concept climate services for olive, grape, and durum wheat	
2	To refine, validate, and upscale the three pilot services with the wider European and global user communities for olive, grape, and durum wheat	
3	To ensure replicability of MED-GOLD climate services in other crops/climates (e.g., coffee) and to establish links to policy making globally	
4	To implement a comprehensive communication and commercialization plan for MED-GOLD climate services to enhance market uptake	
5	To build better informed and connected end-user communities for the global olive oil, wine, and pasta food systems and related policy making	X

2. IMPACT

No.	Expected impact	Yes
1	Providing added-value for the decision-making process addressed by the project, in terms of effectiveness, value creation, optimised opportunities and minimised risk	
2	Enhancing the potential for market uptake of climate services demonstrated by addressing the added value	
3	Ensuring the replicability of the methodological frameworks for value added climate services in potential end-user markets	
4	To implement a comprehensive communication and commercialization plan for MED-GOLD climate services to enhance market uptake	
5	To build better informed and connected end-user communities for the global olive oil, wine, and pasta food systems and related policy making	The deliverable collects material that is useful to transfer the knowledge generated by the project to stakeholders from the target end-user communities and beyond. Effective knowledge transfer has the aim to build capacity within the end-users, increasing their understanding of the provided climate services tools. At the same time, it helps to manage users' expectations and creates trust, which are some of necessary ingredients for the uptake of the provided climate services

3. DEFINITIONS

Concepts and terms used in this document and needing a definition are included in the following table:

Concept / Term	Definition
Dissemination	Public disclosure of the results by any appropriate means (other than resulting from protecting or exploiting the results), including by scientific publications in any medium (EC Research & Innovation Participant Portal Glossary/Reference Terms).
Communication	Process strategically planned that starts at the outset of the project and continues throughout its entire lifetime, aimed at promoting both the project and its results to multitude of audiences, including the media and the public and possibly engaging in a two-way exchange (EC Research & Innovation Participant Portal Glossary/Reference Terms).
Capacity building	Process by which people, organizations and society systematically stimulate and develop their capability over time to achieve social and economic goals, including through improvement of knowledge, skills, systems and institutions (United Nations Office for Disaster Risk Reduction).

4. ACRONYMS

Acronyms used in this document and needing a definition are included in the following table:

Acronym	Definition

5. REFERENCES

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.x]:

Ref.	Title	Code	Version	Date
[RD.1]	MED-GOLD Communication, Dissemination and Exploitation Management Plan	D7.1		2018
[RD.2]	Dissemination and Capacity Building Materials n.1	D6.3		2019
[RD.3]	Compilation of Publications Abstracts n.2	D6.19		2020
[RD.4]	Summary of Dissemination and Communication Activities n.3	D6.23		2020

6. DISSEMINATION AND CAPACITY BUILDING MATERIALS

Following the same structure as D6.3, the present deliverable constitutes an update of D6.3, about new project dissemination and capacity building materials. It includes scientific publications, project deliverables, poster and oral presentations in relevant events (excluding those with a communication purpose only), materials for training and workshops, info sheets, webinars and policy briefs. When possible, materials are collected and displayed in this deliverable. For materials not shown here, such as presentations or deliverables, the link to the original file is provided when publicly available. Note that a description of materials such as newsletters, project news, press releases and interviews or the MED-GOLD promo videos have not been included because they are considered communication rather than dissemination materials, even though in some occasions they can also be used for dissemination purposes.

Table 6-1 presents an updated compilation of the dissemination and capacity building materials that have been developed so far in the MED-GOLD project, describing the target audiences and the channels used to reach them. Upcoming sections 6.1-6.8 present the new materials developed from M25 (December 2019) to M36 (November 2020).

Table 6-1 Dissemination and capacity building materials developed to date in MED-GOLD

Materials	Channels	Target Audience	Language	Link
Scientific publications (peer and non-peer reviewed)	Project website Social media Project newsletter	Research	EN (except particular cases)	List of publications
Project deliverables	Project website Project newsletter	Project consortium Research	EN	Public deliverables on the project website
Presentations in relevant events (including interactions with other initiatives)	Conferences, meetings	Research Industry Policy makers	EN, IT, PT, ES, GR	
Materials for training and workshops	Workshops Living Lab	Research, ECRs Farmers Industry and other commercial players Media	EN, IT, ES, PT, GR	Living lab sessions materials Living lab videos on YouTube Workshops materials available here: olive/olive oil, grape/wine, durum wheat/pasta.
Infosheets	Project website Social media Workshops Project newsletter	Farmers Industry and other commercial players Public organisations Policy makers Research	EN, IT, ES, PT, GR, FR	Project website
Webinars	Webinar platform Project website Social media Project newsletter	Research Farmers Industry and other commercial partners Public organisations Policy-makers Media	PT, EN	Project website
Policy brief	Project website	Policy-makers Commercial players (e.g. cooperatives, trade organizations)	EN	Ongoing

6.1. SCIENTIFIC PUBLICATIONS

Scientific publications are presented in Table 6-2. During this last year (December 2019-November 2020) 8 new articles have been published (see abstracts below) and 2 more are under review.

Table 6-2 Peer-reviewed scientific publications

#	Publications
1	Graça, A. and MED-GOLD Consortium (2019) The MED-GOLD project: Advanced user-centric climate services for higher resilience and profitability in the grape and wine sector. BIO Web of Conferences 12, 01005, https://doi.org/10.1051/bioconf/20191201005.
2	Teixeira, M., Fontes, N., Costa, C., Graça, A. (2019) Resiliência e adaptação: uso de informação histórica para prever a qualidade de uvas e vinhos numa determinada propriedade da Região Demarcada do Douro. Livro das actas do 11º simpósio de vitivinicultura do Alentejo, https://www.researchgate.net/publication/33597132.
3	Mihailescu, E., Bruno Soares, M. (2020) The Influence of Climate on Agricultural Decisions for Three European Crops: A Systematic Review. Frontiers in sustainable food systems 4: 64, ood Syst. 4:64, https://doi.org/10.3389/fsufs.2020.00064.
4	Zampieri, M., Weissteiner, C.J., Grizzetti, B., Toreti, A., van den Berg, M., Dentener, F. (2020) Estimating resilience of crop production systems: From theory to practice. Science of The Total Environment, Volume 735, 15 September 2020, 139378, https://doi.org/10.1016/j.scitotenv.2020.139378.
5	Cure, J.R., Rodriguez, D., Gutierrez, A.P., Ponti, L. (2020) The coffee agroecosystem: bio-economic analysis of coffee berry borer control (Hypothenemus hampei). Sci Rep 10, 12262, https://doi.org/10.1038/s41598-020-68989-x.
6	Santos, J.A., Ceglar, A., Toreti, A., Prodhomme, C. (2020) Performance of seasonal forecasts of Douro and Port wine production. Agricultural and Forest Meteorology 291 108095, https://doi.org/10.1016/j.agrformet.2020.108095.
7	Ceglar, A., Zampieri, M., Gonzalez-Reviriego, N., Ciais, P., Schauberger, B., Van Der Velde, M. (2020) Time-varying impact of climate on maize and wheat yields in France since 1900. Environmental Research Letters, https://doi.org/10.1088/1748-9326/aba1be.
8	Campos, M.R., Béarez, P., Amiens-Desneux, E., Ponti, L., Gutierrez, A.P., Biondi, A., Adiga, A., Desneux, N. (2020) Thermal biology of Tuta absoluta: demographic parameters and facultative diapause. Journal of Pest Science, https://doi.org/10.1007/s10340-020-01286-8.
9	Sanderson, M., Teixeira, M., Fontes, N., Graça, A. Extreme rainfall in the Douro Valley. Environmental Research Letters (under review)
10	Bojovic, D., Lera St.Clair, A., Christel, I., Terrado, M., Stanzel, P., Gonzalez, P, Palin, E. Engagement, involvement and empowerment: three realms of a co-production framework for climate services. Global Environmental Change (under review)

#1 Graça et al. 2019

Abstract: Agriculture is primarily driven by weather. Forecast climatic conditions will further increase its vulnerability to crop failure and pest damage. Nowhere will this have consequences as dramatic as in the Mediterranean Basin. The challenge here is how to increase resilience of this complex ecological, economic, and cultural heritage in an era of decreasing resources and climate change. Climate services have the potential to support the transition towards a climate-resilient and low-carbon society. The MED-GOLD project will demonstrate the proof-of-concept for climate services in agriculture by developing case studies for three staples of the Mediterranean food system: grape, olive and durum wheat. The new climate services for agriculture developed by MED-GOLD will provide targeted information to companies that will allow them to act over longer time periods (months, seasons or even decades into the future) that go beyond the traditional 2–5 days provided by current weather forecasts. The cumulative benefit of MED-GOLD will range from enhancing agricultural management to supporting and informing policy-making at the Mediterranean, European and global levels. This is because olives, grapes, and durum wheat are grown across the globe and produce the raw materials for global food commodities such as olive oil, wine and pasta.

#2 Teixeira et al. 2019

Abstract: O clima é um dos principais fatores que afetam a qualidade das uvas e dos vinhos com elas produzidos. As alterações climáticas recentes são cada vez mais evidentes, condicionando a composição e qualidade das uvas. Conseguir estabelecer relações entre a evolução do clima e da qualidade das uvas no passado, poderá permitir prever a qualidade das uvas a produzir no futuro, em função dos cenários de projeções climáticas disponíveis e, assim, analisar qual a resiliência do «terroir» numa região vitícola. O objetivo deste trabalho foi comprovar se existe uma relação próxima entre a maturação da uva de diferentes castas em parcelas de uma propriedade da Região Demarcada do Douro e índices bioclimáticos observados localmente. Para o estudo foram usados dados históricos, meteorológicos, e de maturação da uva de diferentes castas, no período entre 1991 a 2017. Verificou-se a existência de correlações significativas entre índices bioclimáticos e índices de extremos climáticos, bem como entre os índices climáticos e a qualidade das uvas à maturação. Usando estas correlações, juntamente com projeções climáticas de alta resolução, realizamos uma reflexão sobre a resiliência da qualidade das uvas e sua adequação aos vinhos nos próximos 60 anos, para prever eventuais medidas de adaptação.

#3 Mihailescu and Bruno Soares 2020

Abstract: The severity and uneven distribution of the expected climate change impacts across climate-sensitive agricultural areas, and the cropping systems operated within, call for identification, and effective management of these impacts.The climate services have the potential to help identifying and adequately addressing the expected changes in climate and their impacts on agricultural production systems. However, the development of effective climate services is conditioned by the need to clearly understand the critical decisions that underpin end-users' activities and how climate information can support those decision-making processes. This paper reviews and identifies the main decisions linked to key climate change impacts on the cropping systems of interest—olive,grape and durum wheat—in order to inform the development of climate services for these crops in the future. Our review results indicate two types of key findings: (i)the most common types of decisions across the three cropping systems address the increase in temperature, variability, and uneven distribution of rainfall, occurrence of extreme events, and increased solar radiation; (ii) the most common decisions are likely to be affected by an increase in temperature above the maximum supported by the three crops, or in combination with other impacting climate changes. These decisions mainly relate to irrigation and other water stress reducing measures (olive,durum wheat), choice of varieties (grape, durum wheat), clones and rootstocks (grape),training system and vine load (olive, grape), canopy management (olive, grape), change in planting/sowing and harvest date (olive, durum wheat), pest and disease management(grape), allocation/choice of cultivation area (grape, durum wheat), use of decision support tools (grape), and crop insurance (durum wheat). In these decision-making contexts, the timely availability of climate information on temperature increase and rainfall variability can be used for developing climate services to effectively support the affected decisions. Although this paper does not provide an exhaustive analysis, the entry points identified can be considered as starting points for informing the development of climate services to further support the adjustment of decision making for the identified olive,grape, and durum wheat cropping systems, as well as similar decision-making contexts beyond those identified here.

#4 Zampieri et al. 2020

Abstract: Agricultural production systems are sensitive to weather and climate anomalies and extremes as well as to other environmental and socio-economic adverse events. An adequate evaluation of the resilience of such systems helps to assess food security and the capacity of society to cope with the effects of global warming and the associated increase of climate extremes. Here, we propose and apply a simple indicator of resilience of annual crop production that can be estimated from crop production time series. First, we address the problem of quantifying resilience in a simplified theoretical framework, focusing on annual crops. This results in the proposal of an indicator, measured by the reciprocal of the squared coefficient of variance, which is proportional to the return period of the largest shocks that the crop production system can absorb, and which is consistent with the original ecological definition of resilience.

#5 Cure et al. 2020

Abstract: Coffee, after petroleum, is the most valuable commodity globally in terms of total value (harvest to coffee cup). Here, our bioeconomic analysis considers the multitude of factors that influence coffee production. The system model used in the analysis incorporates realistic field models based on considerable new field data and models for coffee plant growth and development, the coffee/coffee berry borer (CBB) dynamics in response to coffee berry production and the role of the CBB parasitoids and their interactions in control of CBB. Cultural control of CBB by harvesting, cleanup of abscised fruits, and chemical sprays previously considered are reexamined here to include biopesticides for control of CBB such as entomopathogenic fungi (Beauveria bassiana, Metarhizium anisopliae) and entomopathogenic nematodes (Steinernema sp., Heterorhabditis). The bioeconomic analysis estimates the potential of each control tactic singly and in combination for control of CBB. The analysis explains why frequent intensive harvesting of coffee is by far the most effective and economically viable control practice for reducing CBB infestations in Colombia and Brazil.

#6 Santos et al. 2020

Abstract: Wine production is intricately dependant on the evolution of weather conditions in a given year. Therefore, seasonal weather forecasts coupled with empirical wine production models can play a critical role in the short to medium-term management of vineyards and wineries. The implementation of suitable and timely adaptation measures based on predicted wine productions may contribute to risk reduction and improve efficiency. The performance of seasonal forecasts of wine production in the Portuguese Douro & Port wine region (D&P WR) is here assessed for the first time. This application may serve as a case study to be potentially extended to other wine regions. Here, we develop a predictive logistic model of wine production based on monthly mean air temperatures and monthly total precipitation, averaged over the periods of February–March, May–June, and July–September, complemented with an autoregressive component of wine productions. The wine production in the D&P WR during the period 1950–2017 (68 years) is keyed into three classes: low, normal and high production years. The model reveals a correct estimation ratio of approximately 3/4 for the full period, and 2/3 when applied to independent 10%-random subsamples. We then evaluate the performance of the ECMWF 7-month seasonal weather forecasts, issued from February to August, in predicting the meteorological conditions relevant for the wine production in the D&P WR. Overall, the performance is satisfactory for the meteorological predictors. As for the weather forecasts coupled with the wine production model, results reveal that forecasts from May to August are strikingly the best performing, as 1) more observed data is integrated into the empirical model and 2) the skill of seasonal forecasts for summer months is higher. The operational application of these forecasts in the D&P WR is already foreseen. Given the encouraging results, we believe this case study and the established methodology may be tested and adapted to other wine regions worldwide, with obvious benefits for the winemaking sector.

#7 Ceglar et al. 2020

Abstract: Climate services that can anticipate crop yields can potentially increase the resilience of food security in the face of climate change. These services are based on our understanding of how crop yield anomalies are related to climate anomalies, yet the share of global crop yield variability explained directly by climate factors is largely variable between regions. In Europe, France has been a major crop producer since the beginning of the 20th Century. Process based and statistical approaches to model crop yields driven by observed climate have proven highly challenging in France. This is especially due to a high regional diversity in climate but also due to environmental and agro-management factors. An additional level of uncertainty is introduced if these models are driven by seasonal-to-decadal surface climate predictions due to their low performances before the harvesting months of both wheat and maize in western Europe. On the other hand, large scale circulation patterns can possibly be better predicted than the regional surface climate, which offers the opportunity to rely on large scale circulation patterns as an alternative to local climate variables. This method assumes a certain degree of stationarity in the relationships between large scale patterns, surface climate variables, and crop yield anomalies. However, such an assumption was never tested, because of the lack of suitable long-term data. This study uses a unique dataset of subnational crop yields in France covering more than a century. By calibrating and comparing statistical models linking large scale circulation patterns and observed surface climate variables to crop yield anomalies, we can demonstrate that the relationship between large scale patterns and surface variables relevant for crop yields is not stationary. Therefore, large scale circulation pattern based crop yield forecasting methods can be adopted for seasonal predictions provided that regression parameters are constantly updated. However, the statistical crop yield models based on large-scale circulation patterns are not suitable for decadal predictions or climate change impact assessments at even longer time-scales.

#8 Campos et al. 2020

Abstract: The South American tomato pinworm, Tuta absoluta, (SATP) is now a devastating pest worldwide of crops in the family Sola- naceae. Most prior studies of SATP's thermal biology were based on populations from tropical regions, and proved unsuitable for explaining its invasion of large areas of the Palearctic. A more holistic approach to the analysis of its thermal biology is an essential background for developing models to assess its invasive potential. Our studies found that SATP has lower and upper thermal thresholds (θ L = 5.37°C and θ U = 35.69°C, respectively) than South American populations used in prior studies (θ L = 7.38°C and θ U = 33.82°C). Age-specific life tables were used to estimate the effects of temperature on its demographic parameters. Diapause in SATP had not been characterized prior to our study. We found facultative diapause in pupae develop- ing from larvae exposed to relatively low temperatures (i.e., 2 and 5°C) and short-day length for different exposure periods. The strength of diapause was measured as an increase in post-treatment developmental times of pupae (i.e., degree days) that on average were 2.45–3-fold greater than of pupae reared at favorable temperatures. A lower developmental threshold and a facultative diapause increase the invasive potential of SATP in temperate areas. Knowledge of this thermal biology is essential for predicting the potential geographic spread of this pest and to develop management and control strategies.

6.2. PROJECT DELIVERABLES

In addition to the publication of articles, public project deliverables are also a way to disseminate the results, mainly among the scientific community but also among other stakeholders. The list of new public deliverables available on the project website is provided in Table 6-3.

Table 6-3 Public deliverables available online

Deliverable #	Title
D2.2	Report on the olive tool performance
D2.7	Second feedback report from users on olive oil pilot service development
D3.2	Report on the methodology followed to implement the wine pilot services
D3.7	Second feedback report from users on wine pilot service development
D4.2	Design of innovative agro-climatic systems for durum wheat
D4.7	Second feedback report from users on durum wheat pilot service development
D6.6	Living Lab event n.1

6.3. PRESENTATIONS IN RELEVANT EVENTS

Presentations reporting project results in relevant events during the last 12 months are listed in Table 6-4. In the case of events with submitted abstracts, a compilation can be found in D6.19 [RD.3]. In this occasion all presentations have been oral, either face-to-face or online (after implementation of travel restrictions due to COVID-19).

Table 6-4 Presentations in relevant events

#	Title of the presentation, Event, Location, Dates	Presentation type
1	**General presentation of the MED-GOLD project results and Summer School**, Third General Assembly of the VISCA project, Barcelona, Spain, 11-12 December 2019 (Figure 6-1)	Oral
2	**General presentation of the MED-GOLD project**, Digitalisation of new technologies in agri-food, Antequera, Spain, 12 December 2019 (Figure 6-2)	Oral
3	**The Horizon 2020 MED-GOLD project and its ICT platform for developing climate services in agriculture**, National Coordination Table in the field of Agrometeorology, Rome, Italy, 13 December 2019	Oral
4	**Exploring the added value of MED-GOLD climate services across crops and agricultural regions**, International Conference on Climate Services-6 (ICCS6), Prune, India, 11-13 February 2020	Oral
5	**MED-GOLD overview and activities for the olive sector**, III Olea International Project Networking Event, online event organised by the University of Jaén, Spain, 27 May 2020	Oral
6	**The MED-GOLD climate services** (with focus on the olive sector), Smart Agrifood Summit, Málaga, Spain, 24-25 September 2020	Oral
7	**Project MED-GOLD - Climate services for agriculture**, Master in Applied Biology at Universidad Militar Nueva Granada Colombia, 1 October 2020	Lecture

Figure 6-1 VISCA third General Assembly attended by some MED-GOLD partners

Figure 6-2 Event 'Digitalisation of new technologies in agri-food' at DCOOP premises

6.4. MATERIALS FOR TRAININGS AND WORKSHOPS

The MED-GOLD project organised a Living Lab to present the most recent methodologies for the co-production of climate services with end-users following a hands-on approach. The Living Lab was originally planned as a Summer School to be held in Cagliari (Italy) between 25 and 29 May 2020, but it was converted during spring 2020 into a remotely-based training event owing to the COVID-19 situation (Figure 6-3).

Some already existing project dissemination and capacity building materials (project deliverables, publications, info sheets, etc.) were used as background information for students to start familiarizing with the project topics. At the same time, additional materials were generated, mainly consisting of presentations and video recordings that can be accessed online on the Living Lab page.

The general program of the Living Lab included five plenary sessions, which were recorded and are freely accessible on the project YouTube channel:

- **Session 1**, 25 May 2020, including presentations by Carlo Buontempo (ECMWF), António Graça (Sogrape Vinhos), Chiara Monotti (Barilla), Ilaria Danesi (Danesi Caffè). https://youtu.be/7GPoKl0qtoA
- **Session 2**, 4 June 2020, including presentations by Marta Bruno Soares (Univ. Leeds). https://youtu.be/JXuu19He6q0

- **Session 3**, 11 June 2020, including presentations by Ronald Hutjes (Univ. Wageningen), Alessandro Dell'Aquila (ENEA) and Massimiliano Pasqui (CNR). https://youtu.be/S1SXrDbf_0g
- **Session 4**, 18 June 2020, including presentations by Marta Terrado (BSC) and Sandro Calmanti (ENEA). https://youtu.be/95me7kAsGgQ
- **Session 5**, 25-06-2020, including presentations by Natalie Suckall (Univ. Leeds), Federico Caboni (BeeToBit), Michael Sanderson (Met Office). https://youtu.be/QEdyDpm8ios

Participants to the living were challenged by real users of climate information, who were referred to as problem-holders during the training, to develop climate services for the agri-food sector building on the knowledge and skills shared by users during the event. With this purpose, students worked in three groups - the GREEN, RE-WINE and RisCOFF teams - to meet the challenges presented by the problem-holders in the wine and coffee sectors. Students' works can also be accessed on the Living Lab page.

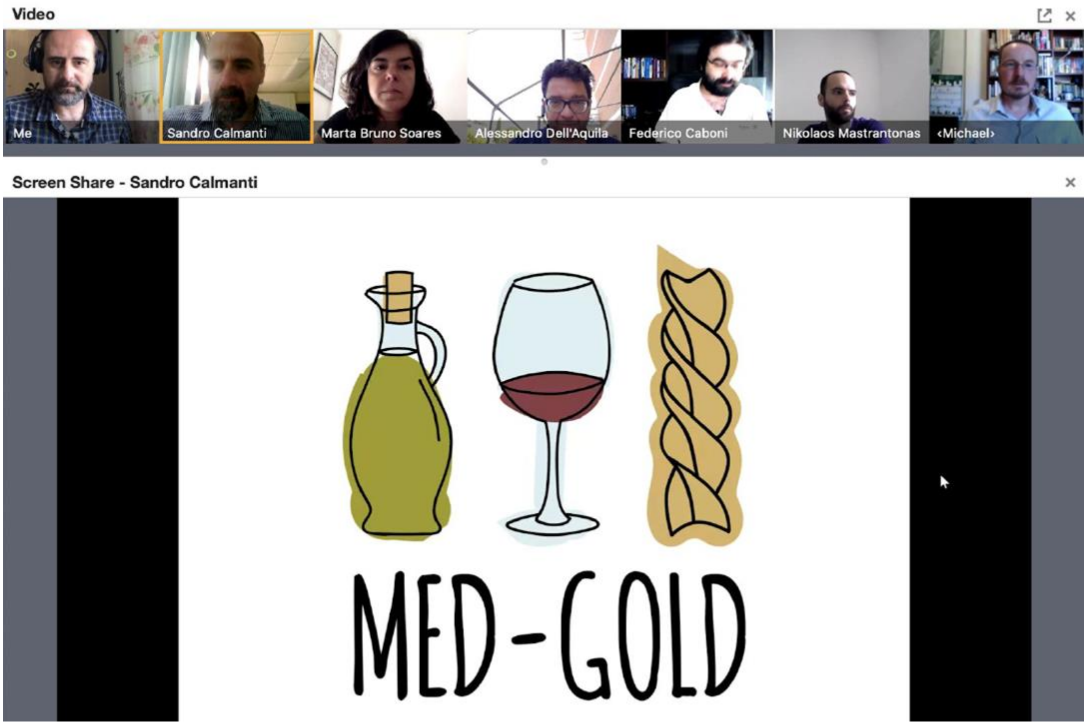

Figure 6-3 MED-GOLD Living Lab

6.5. INFO SHEETS

Three additional info sheets have been developed during the last year, which have been published in the different project languages (EN, PT, ES, IT, GR, FR) with the objective to enhance user engagement. These info sheets include:

- Climate services for the coffee sector: with a general overview on how climate services can be applied for making decisions in a different sector not initially targeted by the project: the coffee sector.
- Time scales of climate services for agriculture: highlighting the main differences among climate information at different time scales, including forecasts from the past (hindcasts), weather forecasts, climate predictions and climate projections.
- Climate predictions for agriculture: explaining how climate predictions for the next months and seasons are obtained, how they should be interpreted and how to know if they are of sufficient quality to be reliably used for decision making.

The info sheets have been developed in close collaboration with stakeholders involved in the project. They have been made available through the project website and newsletter and have been disseminated through social media. To enhance their distribution, they will be slightly adjusted and included on the MED-GOLD dashboard, as supporting material that can guide users on how to interpret and use the information available on the platform while building capacity among users. An additional info sheet on climate projections for agriculture is currently under development.

See available info sheets in Annex A.

6.6. WEBINARS

A webinar on '*What are the time scales of climate services for agriculture?*' was organised on April 21, 2020. The webinar was run in English and mainly targeted agriculture stakeholders but also other stakeholders interested in the use of climate information and services to adapt to climate change.

The webinar was advertised through the project newsletter, which is sent to members of the MED-GOLD community who gave consent to receive this type of information. The announcement was also disseminated online on the project website and through social media. More than a hundred people registered, from which 90 finally attended the webinar. The GoToMeeting platform was used, which allowed to make the session a bit more interactive through the use of quizzes. Those questions that could not be answered during the webinar were posted afterwards on the project Forum to give participants the option to continue the discussion there. Webinar materials, including a summary of the webinar, the recording and the presentation used were uploaded to the project website and on the YouTube channel.

Webinar announcement

According to the WMO 2019 global analysis, many countries highlight agriculture and food security as critical priority sectors for climate change adaptation, with weather and climate services being the foundation element for planning and decision making. However, what is meant by 'climate services' is not always clear to users in the agricultural and other sectors. These users often strive for understanding which type of information these services provide, at which time scales, and how it can specifically support the decisions they need to make in the field. This understanding is not trivial, since it is actually what allows the uptake of climate services and makes their use sustainable in the long term. If climate services are available but are not used to support crop management and take any other informed decisions, they are of no value.

In this webinar, MED-GOLD researchers and sector users (Figure 6-4) will explain the difference between the time scales of climate services for agriculture, including weather forecasts, seasonal predictions, decadal predictions and climate change projections. Participants to the webinar will have the opportunity to discover how predictions of climate variables (e.g. temperature, precipitation, etc.) and agro-climatic indices (e.g. total spring rain, etc.) are made for different crops. Speakers will also explain how to interpret probabilistic predictions, their advantages and limitations and how this knowledge translates into concrete actionable advice for the management of crops and food systems, including grapes/wine, olive/olive oil, durum wheat/pasta and coffee.

Questions received from the audience

1. How many farmers use the granoduro.net platform?
2. Are seasonal forecasts and climate projections freely available for the whole Mediterranean regions in Copernicus or ECMWF platforms?
3. Many thanks for the organization of this informative Webinar. I have a question about the model's skills that was presented in the first presentation. How is it possible to measure the skills of the model? Is this parameter a good indication to choose the predictions that suit the best respect to the area under investigation?
4. Is the access to MED-GOLD services and data open?
5. Is this modelling service a "user pays" service or is it a free service to subscribers?
6. For me, that I have just started to work for my company that produces hard wheat, where can I find information for this topic?
7. What are the challenges/solutions with RCP 8.5 projections for the different types of crops? should we think to change those crops or there are some adaptation/solutions?
8. Can the RCP8.5 scenario still be considered of the same importance? CoronaVirus emergency can change the future perspective of industrial sectors in the world…
9. Wine producing is a very specialized task and with strong traditional houses. Are there any adaptations that grape producers can adopt, in view of temperatures rise, that allow them to keep the vines?

10. Is it possible to predict even short but intense events that can compromise productions? How long?

Figure 6-4 Speakers in the webinar 'What are the time scales of climate services for agriculture?'

6.7. POLICY BRIEFS

Some interactions with members of the policy community and related stakeholders have been conducted so far to identify and discuss topics of policy interest. This includes organisations like Union for the Mediterranean (UfM), COPA-COGECA, the Spanish Ministry of Agriculture, Fishing and Food, the European Committee of Wine Enterprises (CEEV), the Sardinian Department of Agriculture and the Sardinian Association of Agricultural Engineers.

So far, the project has provided feedback to the draft of the sustainable food 'Farm to fork' strategy from the European Commission, one of the pillars of the European Green Deal.

Although one policy brief was initially planned towards the end of the project, this strategy has been adjusted in regards to the different sectors (olive/olive oil, grape/wine, durum wheat/pasta) and areas (Spain, Portugal and Italy) covered by the project. Thus, next activities planned for the exchange of knowledge with the policy community include the development of a **policy brief series** including specific topics and pilot areas and the **organisation of a joint MED-GOLD and VISCA policy event** within the framework of the ERA4CS event 'Climate services for a climate-resilient Europe'.

7. ACTIONS TO ENHANCE THE IMPACT OF DISSEMINATION AND CAPACITY BUILDING MATERIALS

During the second project review, the importance of having a clear strategy for the diffusion of dissemination and capacity building materials generated in the project was highlighted. In addition, the need to assess the impact of those materials, especially in terms of stakeholders' uptake, was stressed.

Occasions to disseminate such materials include specifically-organised stakeholder events (where info sheets have been distributed), particular sectorial events attended by partners (where sectoral promo videos can be displayed) and the project online channels (where newsletters, webinars and living lab recordings, publications, etc. are available). In addition, a compilation of newly-developed materials is sent twice a year through e-mail to the MED-GOLD community members that agree to receive project newsletters and to be notified about other activities organised by the project.

With the aim to enhance mutual understanding between climate scientists, farmers and other sectorial stakeholders and policy makers, a multi-language glossary has been developed and is available on the project website.

Other actions addressed to enhance the impact of dissemination and capacity building materials will be put in place, including:

- **Linking materials to the MED-GOLD Dashboard:** info sheets will be adjusted and uploaded to the MED-GOLD dashboard to support users in appropriately interpreting and using the information for decision-making available on the platform while building capacity among the user community. Once launched, the platform is expected to be showcased to external users in demonstration workshops, webinars, etc. so it is expected that info sheets will reach a wider audience.

- **Showcasing the climate services tools**: New dissemination and capacity building material will be developed with the aim to showcase the various MED-GOLD climate services and how they are connected. At least, an info sheet and/or a short video will be prepared. A webinar or workshop showcasing the tools to the MED-GOLD community and other interested stakeholders will be organised.

- **Twitter action:** Twitter action will be intensified to further promote the use of available communication, dissemination and capacity building and training materials developed by the project. Reuse of previously developed material will also be promoted to increase its impact. Consortium partners will be encouraged to tweet from their personal or institutional accounts to increase the impact of Twitter dissemination.

- **Policy event:** a joint policy event will be organised by MED-GOLD and VISCA projects to enhance the dissemination of project results so that they reach the policy community. The feedback received from policy makers during this event will be useful to tailor the policy briefs that the project is going to develop in the next months.

Knowing the stakeholder uptake of dissemination and capacity building materials is key to assess the impact of dissemination. This can be assessed for many of the developed activities. In Table 7-1, there is a list of potential metrics to be used and their value to date. Values will be updated in the next assessment (D6.16).

Table 7-1 User uptake metrics

Metric	Value
Number of newsletters opened (sent by e-mail to community members that agreed to receive them)	Newsletter #1: 27, Newsletter #2: 46, Newsletter #3: 68, Newsletter #4: 65
Number of attendants to webinars	Webinar #1: 18, Webinar #2: 90
Number of online views of webinar recordings	Webinar #1: 153, Webinar #2: 59
Number of info sheets distributed at stakeholder events	Cagliari workshop: 40 people; Living lab: 19 people
Number of online views of promo videos	Olive/olive oil: 60, Grape/wine: 58, Durum wheat/pasta: 38

ANNEX A. INFOSHEETS

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CLIMATE SERVICES FOR THE COFFEE SECTOR

Coffee is an important global crop and the second most valuable commodity exported by developing countries. More than 120 million people in 70 countries rely on its value chain for their livelihoods (The Climate Institute 2016). Coffee farming is an agricultural activity particularly affected by climate change. Rising temperatures and altered rainfall patterns are already affecting coffee yields, quality, pests and diseases, which in turn represent a threat to economic security in many coffee-producing regions. According to recent studies, 60% wild coffee species are under threat of extinction due to climate change.

MED-GOLD will identify opportunities for the development of climate services for the coffee sector over a range of timescales, that will complement the services offered by in-situ growing associations and cooperatives. Climate information underlying the services will be provided at higher spatial resolution, which is needed to account for geomorphology and improve forecasting at a local level, and with a reduced bias. These climate services tools will include customized products such as climate variables and numerical models that will help optimize both the long-term strategy and the shorter term agricultural crop management.

Time scale	Decision type	Challenges	MED-GOLD climate services tools	Benefits
Mid-term (e.g., 6 months)	Agro-management	• Optimize pest treatment • Anticipate best timing for harvesting	• Temperature • Precipitation • Solar radiation • Relative humidity • Physiological-demographic modelling for pests and productivity	• Reduce pest damage while protecting the environment • Maximize crop yield and quality
	Stock management	• Better estimation of coffee production • Improve the selling process		• Improve stock and selling planning
Long-term (e.g.,5-10 years)	Long-term strategy	• Select production areas • Assess incidence of coffee berry borer • Select appropriate species according to production areas (Robusta vs Arabica) • Select time of crop renovation • Define plant density	• Temperature • Precipitation • Solar radiation • Relative humidity • Physiological-demographic modelling for pests and productivity	• Future productivity per production area • Regional recommendations for improved crop management strategy • Cost-benefit analysis per production area • Exploitation adaptation and investment evaluation

Figure A-1 Infosheet 'Climate services for the coffee sector', side 1

Selection of appropriate coffee species

Colombia's coffee region is increasingly vulnerable to climate-change-induced disasters like flooding, drought and invasive pests. Traditionally, the country has been known as a top producer of *coffee arabica*, an emblematic Colombian crop that is cultivated at middle altitudes (1000-2000m) in the Colombian Andes. Unusual weather events related to climate change have direct and indirect impacts on *C. arabica*. A different species not widely cultivated in the country, *C. robusta*, seems to be a suitable alternative that, despite being affected by climate extremes, can tolerate higher temperatures and is more resistant to pests and diseases. Therefore, the coffee-growing areas could expanded into warming regions with *C. robusta* to counteract the *C. arabica* yield reductions. These new regions would be flat locations below 1200m, which in Colombia receive the name of *Orinoquía*, *Pacífico*, *Caribe* and 2 specific zones in Amazonia (*Caquetá* and *Putumayo*). *C. robusta* does, however, require higher rainfall, which, because of the increased likelihood of prolonged droughts, means that irrigation is likely to become an increasingly essential requirement.

The UNESCO-recognized coffee cultural landscape of Colombia, also recognized under the *'Café de Colombia'* EU-Protected Geographic Indication, requires specific management that could greatly benefit from the climate services provided by the MED-GOLD project. Besides, better climate forecasts and projections could become a useful tool for policy-making, helping growers associations and economic authorities to understand the impact of climate change on *C. arabica* and the potential expansion of *C. robusta* into warmer areas.

Advantages of having access to long-term climate predictions:

1. **Selection of new production areas** with suitable climate to meet production and quality goals.
2. **Match adequate types of coffee species or even varieties to expected climate.**
3. **Identify years with adverse/favourable climate conditions** for coffee production (bad/good years).
4. **Identify areas where the coffee berry borer pest will limit production**

Glossary

Climate predictions: probabilistic forecasts of climate variables that extend further into the future than weather forecasts, from months and seasons up to decades

Climate services: transformation of climate-related data and other information into customized products such as trends, economic analysis, advice on best practices, and any other climate-related service liable to benefit that may be of use for the society

Phenology: study of the timing of biological events, such as flowering, leafing or reproduction, in plants

Physiological-demographic modelling (PBDM): best approach to study agroecological problems from the perspective of trophic level interactions that include the dynamics of coffee berry production, the coffee berry borer, natural enemies and agricultural practices

Seasonal predictions: probabilistic forecasts of climate variables for the next season (up to 6 months)

Weather forecasts: probabilistic forecasts of climate variables for the next hours and days (up to two weeks)

About MED-GOLD

MED-GOLD, Turning climate-related information into added value for traditional **MED**iterranean **G**rape, **OL**ive and **D**urum wheat food systems, is a 4-year project contributing to make European agriculture and food systems more resilient, sustainable and efficient in the face of climate change by using climate services to minimize climate-driven risks/costs and seize opportunities for added value

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776467

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Figure A-2 Infosheet 'Climate services for the coffee sector', side 2

TIME SCALES OF CLIMATE SERVICES FOR AGRICULTURE

Forecasts can be split into different categories according to the time scale: forecasts of the past, weather forecasts, climate predictions and climate projections, each stretching further into the future than the previous one. A clear understanding of the differences between these time scales helps understanding how this information can specifically support particular decisions that need to be made in the field.

Relevant time scales of decision-making in the agriculture sector (adapted from Nissan et al. 2018)

FORECASTS OF THE PAST

In the field of climate prediction, forecasts of the past are called *hindcasts*, and are useful to assess the forecast quality of the climate model. *Hindcasts* are compared with observations to determine how well the prediction matches the observed results. Testing how the model performs in the past provides information about the quality of future forecasts. We also use *hindcasts* for the analysis of past events. In the field of climate projection, forecasts of the past are used to set the reference period the future projection will be compared against.

WEATHER FORECASTS

Limited to two weeks. They correspond to the weather forecasting information traditionally provided on the radio and TV, where meteorological phenomena are described in high detail for a particular moment and location. However, trust in weather forecasts is quickly lost after about a week, becoming less useful thereafter. Their ability to forecast weather comes from real-time measurements of the current conditions of the atmosphere.

CLIMATE PREDICTIONS

Extending from weeks to decades (sub-seasonal, seasonal and decadal predictions). Unlike weather forecasts, which use real-time measurements of the current conditions of the atmosphere, climate predictions use elements of the climate system that evolve slowly over time: oceans, sea ice, soil water content, snow, etc. Climate predictions make use of average conditions (e.g. average ocean temperature), whose evolution can be potentially anticipated over longer time spans. Therefore, the type of questions that we can answer with climate predictions is different from the ones that can be answered with weather forecasts. Thus, the interest of climate predictions is not in the amount of rainfall at a particular time and location, but in how the average monthly rainfall at that location could evolve, for instance.

CLIMATE PROJECTIONS

Extending from decades to centuries. Climate projections require scenario hypotheses, which are based on future estimated levels of greenhouse gases and socio-economic development. These scenarios are used to provide plausible descriptions of how the future climate may evolve (typically until 2100) with respect to a range of variables including socio-economic and technological change, energy and land use, and emissions of greenhouse gases and air pollutants. The current set of scenarios adopted by the Intergovernmental Panel on Climate Change (IPCC) are the Representative Concentration Pathways (RCPs).

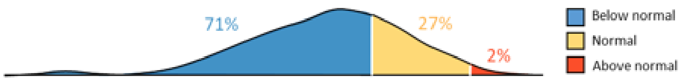
Figure A-3 Infosheet 'Time scales of climate services for agriculture', side 1

WEATHER FORECASTS

Weather forecast for Porto. Source: BBC Weather.

Weather forecasts provide **precise information** about atmospheric variables (e.g. temperature, rainfall, wind speed) for a specific location and for the following hours and days.

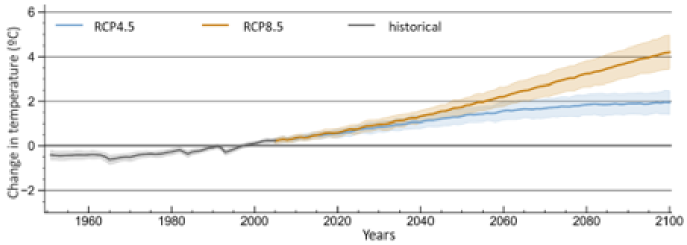
CLIMATE PREDICTIONS



Climate prediction of the mean temperature in Porto for the next season (e.g. spring). The graph indicates 71% of probability that the temperature will be below normal (i.e. below the average of the mean temperature in spring of the last ~30 years), 27% of probability to be normal (i.e. the average mean temperature of the last springs) and 2% probability to be above normal (i.e. above the average of the mean temperature of the last springs). Source: BSC-CNS.

Climate predictions provide **probabilistic information** about atmospheric variables with reference to the average of past observations, e.g. last ~ 30 years (that is considered the *normal*). Information is often presented using three categories or *terciles*, each category corresponding to the probability of a particular variable (e.g. mean temperature) to be *below normal*, *normal* or *above normal* in the next months or seasons. To know if the prediction is good enough for decision-making, it is necessary to know whether it has *skill [see info sheet Climate predictions for agriculture]*.

CLIMATE PROJECTIONS



Climate projections of mean temperature in Porto for the period 1950-2100 relative to 1986-2005. The graph indicates an increase of temperature by the end of the century. Projections using RCP4.5 project an increase in temperature of around 2ºC whereas those using RCP8.5 expect an increase of more than 4ºC. Solid lines correspond to the multi-model mean (i.e. average results across different models). Shading corresponds to the standard deviation, indicating uncertainty. Source: BSC-CNS.

Climate projections provide information about the **variation of atmospheric variables** over the coming decades and centuries. They are often presented as a range of the results obtained using RCPs. Frequently used RCPs are RCP4.5 (intermediate greenhouse gas emissions) and RCP8.5 (high greenhouse gas emissions). Projections from many climate models should be analysed as they project different levels of warming and other changes in the climate system *[see info sheet Climate projections for agriculture]*.

WHICH TYPE OF QUESTIONS CAN BE ANSWERED WITH EACH TEMPORAL SCALE ?

Weather forecasts	Climate predictions	Climate projections
Temperature in Porto in the next few days in absolute values (ºC)	Most likely category for next spring temperature in Porto in relative values or anomalies (either below normal, normal or above normal)	Variation of temperature expected in Porto during this century (ºC change)

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Figure A-4 Infosheet 'Time scales of climate services for agriculture', side 2

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CLIMATE PREDICTIONS FOR AGRICULTURE

A frequently-used approach to estimate near-future climatic conditions consists of taking the historical average (i.e. average of observations of the last 20-30 years) for a specific climate variable, place and time of interest. For example, we would assume that the mean temperature for next summer in Seville (Spain) would be equal to the average temperature experienced during summer in Seville in the past years. However, many farming decisions, in reality, are not even based on this historical average. Instead, they use what we call the 'climate memory', which refers to the average climate conditions of the most recent years (what we can remember). Both approaches (the historical average and the climate memory average) assume that future conditions will be similar to past conditions, which has two main shortcomings. First, past conditions can be highly variable, meaning that one year can be dramatically different from the previous one. Secondly, these approaches cannot predict events that have not occurred before, such as extreme events, which are becoming more frequent under the context of climate change.

Climate predictions provide information on how likely it is that the coming months (or seasons, years or decades) **will be more, equal or less warm** (or wet or windy, etc.) **than normal**. In this case, 'normal' refers to the historical average for a particular location and time. To be useful for the agriculture sector, climate predictions need to be tailored to the requirements of users (see **Fig.1**).

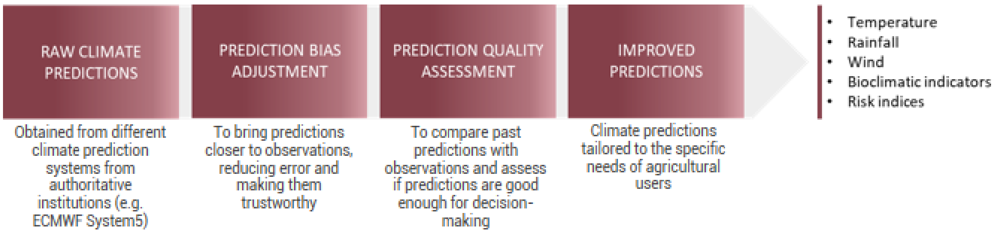

Figure 1. Tailoring climate predictions to user requirements. Source: BSC-CNS

HOW TO INTERPRET CLIMATE PREDICTIONS

Climate predictions are probabilistic. They give information on the probability of certain outcomes to occur. Imagine that we are interested in the temperature of the next month (e.g. May) at a region in the South of Spain. The climate prediction will give us information on the probability for the temperature to be **lower than normal**, **normal** and **higher than normal**. 'Normal' referring to the average temperature of the past years in this region in May.

Probabilities for each of these categories are calculated by running 25 computer simulations of how climate might evolve, each using slightly different initial conditions for climate variables such as wind, temperature, pressure or soil moisture. These conditions must be plausible, i.e. they need to be consistent with current and past climate observations. Because of differences in initial conditions, the result of each simulation will differ from the others and this variation is a measure of the prediction's uncertainty. The more similar results are, the more confident we can be in the prediction.

For the location selected on the map in **Fig.2**, 3 out of the 25 simulations predicted the lower than normal category, 9 the normal category and 13 the higher than normal category. This corresponds to 10% predicted probability of having below normal temperature in May 2016, 38% probability of having normal temperature, and 52% probability of having above normal temperature.

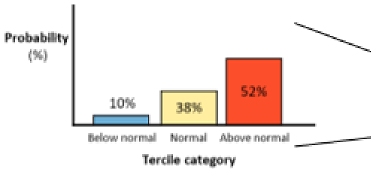

Figure 2. Seasonal prediction of temperature in May 2016 in Europe and percentage of probability predicted at a selected location. Prediction issued one month in advance (April 2016). Colours on the map show the most likely category at each location for Europe. The prediction at the selected location shows the percentage probability for each category. Source: BSC-CNS.

The map in **Fig.2** indicates the most likely category of temperature (i.e. category with the highest predicted probability at each location) and its probability of occurrence (in %). As in this case the 'above normal' category received the highest predicted probability, the selected location is displayed in red on the map. Coloured categories show locations where the model improves upon using the historical average. White areas correspond to locations where either the probability predicted for the three categories is too similar to identify the most likely category OR the quality of the prediction is not good enough to be used for decision-making (skill score below zero, *see reverse for information on skill*).

In white areas, it is better to assume that the temperature in May 2016 will be normal, i.e. equal to the average temperature observed in the last years in May.

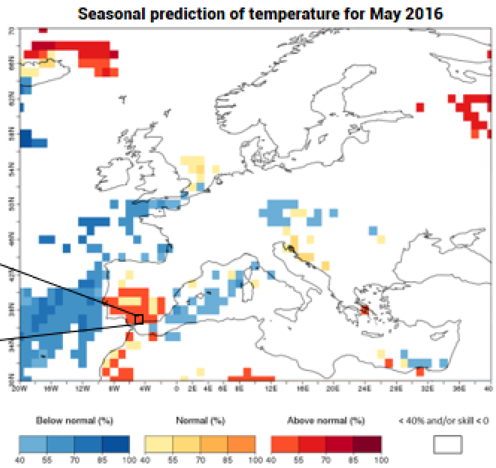

Figure A-5 Infosheet 'Climate predictions for agriculture', side 1

THE QUALITY OF CLIMATE PREDICTIONS

Climate predictions are of little use without information on their quality (skill). The quality of climate predictions is assessed by systematically comparing predictions of the past with observations (i.e. what actually happened) and deriving statistical measures from this comparison. Such measures are called *skill scores* and assess the performance of a climate prediction in relation to a standard (i.e. the alternative to using the prediction). Often, the historical average is used as the standard.

In general, we say that **a prediction has skill** (skill scores greater than zero) **when the number of times that the prediction matches the observation is higher than the number of times that the historical average matches the observation**. In these cases, using the climate prediction for making decisions is better than using the historical average. Conversely, when skill scores are less than zero, the prediction does not have skill, which means that it is better not to use it for decision-making.

Fig.2 (see previous page) was showing a prediction of temperature for May 2016 at a location in the South of Spain. When a farmer gets this prediction, the logical question would be whether (s)he should use it or not. For that, it is crucial to know how the prediction has performed in previous years. **Fig.3** shows the predicted most likely category of temperature for the past years (squares in red, yellow or blue colour) as well as the category in which real-life observations actually fell (black dots) at the mentioned location.

The prediction shown in **Fig.3** has skill. As we can see, the number of years where the prediction matches the observation (9 years, number of black dots in the red, yellow or blue squares) is higher than the number of years where the historical average matches the observation (7 years, number of black dots in the normal category). This means that in this case the prediction provides a better estimate of future climate than the historical average. Using the prediction, is therefore recommended when it has skill. In situations when the prediction has no skill, then the historical average provides a better estimate of future climate.

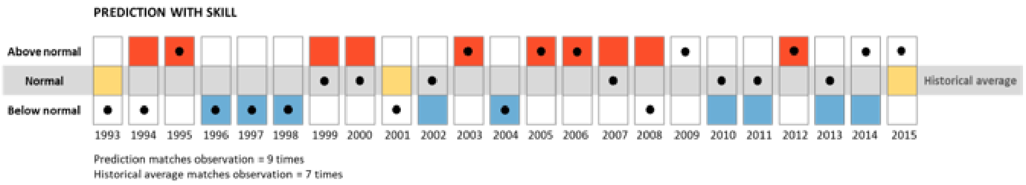

Figure 3. Example of climate prediction with skill. For each year, from 1993 to 2015, the prediction of the temperature for May (issued 1 month in advance) is shown by a coloured square: red indicates that the most likely category for temperature in May is the above normal category, yellow indicates it is the normal category, and blue the below normal category. Years with no colour (such as year 2009) mean that the probability of the different categories is <40%, so a most likely category cannot be clearly distinguished. Note that the normal category, highlighted with a grey shadow, corresponds to the historical average. Black dots indicate the category in which the observation falls. When the black dot falls in a red, yellow or blue square, it means that the prediction matches the observation. Source: BSC-CNS.

It is key to understand that the skill score is obtained by comparing the performance of climate predictions against a benchmark. In the example provided in **Fig. 3**, data for 23 past years are displayed. In this case, the prediction matched the observation in 9 of the years whereas the historical average matched it in only 7 of the years. This leaves 7 additional years for which neither using the prediction nor the historical average would have been useful to know what it actually was going to occur. Despite that, for this example, using the climate prediction has a better outcome than using the historical average and may provide, overall, an added value for making specific decisions.

Single years vs long range

When assessing the added value of climate predictions, we need to move from a short- to a long-term approach, since **the benefits from adopting climate predictions can only be perceived in the long term**. Agricultural users often remember a particular year of the past because it was extremely good or extremely bad in terms of crop production and revenues. Therefore, they would be tempted to look for that particular year in **Figure 3**, to see if the climate conditions for that year were correctly predicted. However, this might provide a wrong impression about how useful climate predictions can be, especially if that year had been 2015, for instance, when normal temperature conditions were predicted but above normal temperatures were observed.

When it comes to climate predictions, we cannot base their performance on individual years. We simply need to accept that the prediction can miss the observation in some particular years. However, one thing is certain: **in areas where the prediction has skill, using it will always be better than using the historical average**.

Final remarks

It is important to be aware that the skill of climate predictions will vary according to the **climate variable of interest** (e.g. temperature, precipitation, etc.), **geographical location** (e.g. tropics, higher latitudes, etc.), **predicted period** (e.g. month of April, summer season, etc.) as well as **how far in advance** the prediction is issued (e.g. one, two, three months before the predicted period, etc.). Windows of opportunity for the use of climate predictions can be found according to each situation.

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Figure A-6 Infosheet 'Climate predictions for agriculture', side 2

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